UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/005,000	12/07/2001	James H. Lee	H-204145	1829

7590 02/16/2005

CARY W. BROOKS
General Motors Corporation
Mail Code 482-C23-B21
P.O. Box 300
Detroit, MI 48265-3000

EXAMINER	
ALEJANDRO, RAYMOND	
ART UNIT	**PAPER NUMBER**
1745	

DATE MAILED: 02/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/005,000
Filing Date: December 07, 2001
Appellant(s): LEE ET AL.

Cary W. Brooks
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 12/02/04.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

US 3982962 Bloomfield 09-1976

US 5938975 Ennis et al. 08-1999

US 3968999 Keller 07-1976

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Bloomfield 3982962.

As for claim 1:

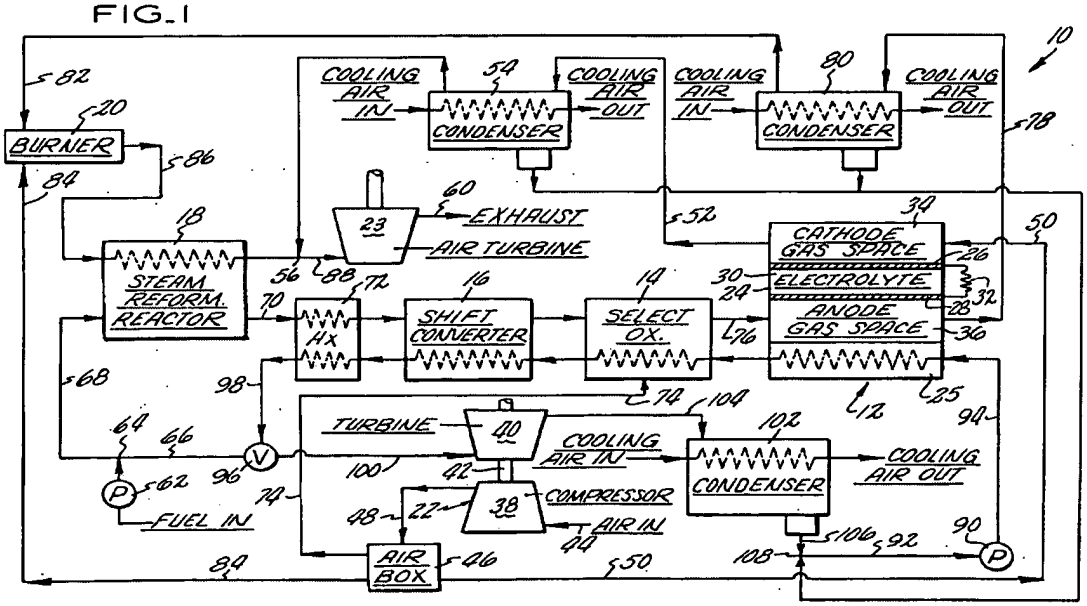
Bloomfield discloses a fuel cell power plant (TITLE) and the process of operating it (COL 5, lines 59-60) comprising as shown in **Figure 1** below a pump 90 delivering water via a conduit 92 into thermal exchange relationship with stack 12 via a conduit 94 by passing the water through the thermal exchange portion 25 of the stack (COL 5, lines 28-32). It is disclosed the fuel cells comprises a single cell 24 and a thermal management portion 25 (COL 3, lines 23-27). Bloomfield discloses that the liquid is increased in pressure by pumps (COL 4, lines 1-5). Bloomfield further discloses that part of the water is changed to steam as it passes through the stack 12. The water and steam is superheated by passing it into heat exchange relationship with the fuel conditioning apparatus. It is further heated in the selective oxidizer 14 and the shift converter 16 and in the heat exchanger 72 (COL 5, lines 32-40). The steam then leaves the heat exchanger 72 and is delivered to a valve 96. Then, the remainder of the superheated stream is delivered into turbine 40 (*the expander*) via a conduit 100. The turbine drives the compressor 38

for compressing the air for the stack. The turbine is a steam driven turbine, however, any steam driven engine operably connected to run a compressor may be used (COL 5, lines 40-50).

Bloomfield further teaches that the exhaust from the turbine 40 is delivered into a condenser 102 via a conduit 104. Heat is removed from the steam by passing air through the condenser as shown. Liquid water, or possibly a mixture of liquid water and steams, leaves the condenser 102 via a conduit 106 and is combined at 108 with water recovered from the anode and cathode effluent gas streams in the condensers 54, 80. The water is then delivered to the pump 90 via the conduit 92 and the process starts again (COL 5, lines 50-62). It is disclosed that the amount of water lost in the Rankine cycle loop is recovered in the condensers 54, 80 and which is combined at 108 with the water which recirculates through the loop (COL 6, lines 1-6).

In summary, Bloomfield's **Figure 1** below illustrates the specific pump 90, the heat generating fuel cell system 24, the turbine 40 (the expander), the compressor 38 and the condenser 102 satisfying the specific spatial relationship, functional configuration and procedural steps as instantly claimed (← *emphasis added*).

FIG_1



Bloomfield discloses alternate embodiments wherein the working fluid is not necessarily water (COL 6, lines 10-17). Bloomfield further discloses that the working fluid which is pumped around the system may be, for example, trichlorofluroethane, commonly known as Refrigerant 113, but any fluid having suitable vapor pressure and temperature characteristics may be employed (COL 6, lines 37-45). It is noted that Refrigerant No. 113 is a chlorofluorocarbon.

Referring now to the Rankine cycle portion of the power plant shown in FIG. 2, the working fluid is pumped around the system by a pump 216. The work-
40 **ing fluid may be, for example, trichlorotrifluoroethane, commonly known as Refrigerant No. 113, but any fluid having suitable vapor pressure and temperature characteristics may be employed. The fluid passes into the**

Second Examiner's note: with respect to the organic liquid, Bloomfield clearly specifies that water recovered from the anode effluent gas streams in the condensers 54 or 80 is combined at mixing point 108 with the cooling fluid of the fuel cell power plant (COL 5, lines 50-62). Bloomfield also teaches that the anode gas stream effluent contains enough unburned gas (emphasis added) such that there is no need for the burner 20 to have a separated fuel supply (COL 4, lines 63-67). It is disclosed that on the anode side, a hydrogen containing liquid fluid such as naphtha is used as the reactant material. In addition, fuels such as methane may be used (COL 4, lines 1-15). It is noted that naphtha and methane are organic fluids. It is further disclosed that although the hydrogen containing liquid fuel such as naphtha is processed in the steam reforming reactor 18 (COL 4, lines 1-5), partial processed fuel leaves the reactor 18 (emphasis added), entering the shift converter 16 to only reduce the carbon monoxide of the gas stream (COL 4, lines 16-27), from the shift converter 16 the gases pass into the selective oxidizer 14 to even further reduce the carbon monoxide content of gases (COL 4, lines 28-36).

Bloomfield also teaches that a shift converter or selective oxidizer is not required (emphasis added), wherein the requirement of the fuel conditioning apparatus are dependent in part upon the type of unprocessed fuel being used (emphasis added) and upon the particular design of the cells (COL 4, lines 40-50). (**emphasis added→**)*Having shown that: a) only partially processed fuel such as naphtha leaves the steam reforming reactor 18; b) no further fuel conditioning such as the shift converter and the selective oxidizer is required; c) unburned gas remains in the anode gas stream effluent, and d) the liquid water or a mixture of liquid water and steam leaving the condenser 102 via a conduit 106 is combined at 108* (← *emphasis added*) *with stream recovered from the anode effluent gas streams, it is stated that some of the unprocessed and unburned naphtha reactant being fed into the reforming unit and the fuel cell will remain in the anode effluent gas stream and thus will be mixed at the mixing point 108 with the cooling water recirculating through the fuel cell cooling system. Accordingly, cooling fluid would includes both water and residual organic liquid naphtha as cooling liquid. That is to say, a mixture of cooling water and the unprocessed and unburned organic naphtha liquid will be circulating through the thermal exchange circuit of the fuel cell system. Therefore, Bloomfield's teachings envision that a mixture of liquid water and unprocessed-unburned organic liquid naphtha might be used as part of the organic cooling fluid of the fuel cell system.*

Bloomfield discloses the fuel cell stack generally comprises a plurality of fuel cells 24 and a thermal management portion 25 (COL 3, lines 23-27/ COL 5, lines 27-31). Thus, the heat generating component comprises the fuel cell stack itself.

Bloomfield discloses other heat generating components such as the selective oxidizer 14 and the shift converter 16 as well as the heat exchanger 72 (COL 5, lines 28-40). The cooling

fluid, for instance, picks up heat from the foregoing heat generating components (COL 5, lines 28-40). In this case, the selective oxidizer and the shift converter represent catalytic combustors.

It is disclosed that on the anode side, a hydrogen containing liquid fluid such as naphtha is used as the reactant material. In addition, fuels such as methane may be used (COL 4, lines 1-15). It is noted that naphtha and methane are organic fluids.

Thus, the claims are anticipated.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bloomfield 3982962 as applied to claim 1 above, and further in view of Ennis et al 5938975.

Bloomfield discloses a process for operating a fuel cell system according to the afore-described aspects. Nonetheless, Bloomfield does not expressly disclose using the shaft work to drive a pump.

Ennis et al disclose a method and apparatus for energy fuel conversion systems (TITLE) including fuel cells (COL 4, lines 18-22/ COL 5, lines 40-45/ COL 23, lines 49-65). It is also disclosed that shaft work of the turbine can be for electrical generation only, or can also include work to operate one or more compressors or pumps (COL 6, lines 4-6).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to employ the shaft work to drive a pump of Ennis et al in the process of Bloomfield because Ennis et al teach that shaft work of the turbine can be used to operate pumps. Hence, this provides an efficient manner of utilizing and optimizing energy consumption in methods and apparatus of total energy fuel conversion.

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bloomfield 3982962 as applied to claim 1 above, and further in view of Keller 3968999.

Bloomfield is applied, argued and incorporated herein for the reasons above. However, Bloomfield does not expressly teach the specific organic cooling fluid as recited in claims 10-11.

Keller discloses that a halo-substituted hydrocarbon like the Freons such as dichlorotetrafluoroethane is a suitable refrigerant for the standard heat exchange apparatus employed in refrigeration plants so as to cool methanol (COL 6, lines 52-68). Keller further discloses that methanol is a prime candidate for generating electricity in fuel cells, being one of the few known fuels suited to fuel cell power generation (COL 10, lines 8-20).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific organic cooling fluid of Keller in the fuel cell system of Bloomfield as Keller discloses that a halo-substituted hydrocarbon like the Freons such as dichlorotetrafluoroethane is a suitable refrigerant for the standard heat exchange apparatus because it has very little energy requirements as well as because this refrigerant is conventionally available and its selection and use in conventional refrigeration apparatus is tailored to the temperatures needed in the heat exchanger. In addition, since Keller discloses that dichlorotetrafluoroethane is a suitable refrigerant for the standard heat exchange apparatus employed in refrigeration plants so as to cool methanol, and given that Keller has also disclosed that methanol is a prime candidate for generating electricity in fuel cells, it is further contended that those of ordinary skill in the art would have sufficient motivation to use Keller's refrigerant in methanol fuel cells or fuel cells employing methanol. That is, in view of Keller's teaching, the technology for cooling methanol is applicable and employable in fuel cells operated by using methanol as fuels. Moreover, this is also consistent with the fact that Bloomfield clearly discloses that the working fluid is not necessarily water and the working fluid may be any fluid having suitable vapor pressure and temperature characteristics. Thus, Keller and Bloomfield are pertinent to each other as they both address the same problem of providing suitable cooling fluids or refrigerant for fuel cells.

(10) Response to Argument

Appellant's arguments filed 12/02/04 have been fully considered but they are unpersuasive.

The main contention of appellant's argument is grounded on the allegation that the prior art of record fail to disclose using an organic cooling fluid at all or flowing the organic based liquid cooling fluid through fuel cell components. However, this assertion is respectfully disagreed with because as noted in the rejection above the prior art (Bloomfield) clearly specifies that water recovered from the anode effluent gas streams in the condensers 54 or 80 is combined at mixing point 108 with the cooling fluid of the fuel cell power plant (COL 5, lines 50-62). Bloomfield also teaches that the anode gas stream effluent contains enough unburned gas (← emphasis added) such that there is no need for the burner 20 to have a separated fuel supply (COL 4, lines 63-67). Bloomfield further discloses that on the anode side, a hydrogen containing liquid fluid such as naphtha is used as the reactant material. In addition, fuels such as methane may be used (COL 4, lines 1-15). It is noted that naphtha and methane are organic fluids. It is further disclosed that although the hydrogen containing liquid fuel such as naphtha is processed in the steam reforming reactor 18 (COL 4, lines 1-5), partial processed fuel leaves the reactor 18 (emphasis added), entering the shift converter 16 to only reduce the carbon monoxide of the gas stream (COL 4, lines 16-27) from the shift converter 16 the gases pass into the selective oxidizer 14 to further reduce the carbon monoxide content of gases (COL 4, lines 28-36). Bloomfield also teaches that a shift converter or selective oxidizer is not required (emphasis added), wherein the requirement of the fuel conditioning apparatus are dependent in part upon the type of unprocessed fuel being used (emphasis added) and upon the particular design of the cells (COL 4, lines 40-50).

(*emphasis added*→) Therefore, having shown that: a) only partially processed fuel such as naphtha leaves the steam reforming reactor 18; b) no further fuel conditioning such as the shift

converter and the selective oxidizer is required; c) unburned gas remains in the anode gas stream effluent, and d) the liquid water or a mixture of liquid water and steam leaving the condenser 102 via a conduit 106 is combined at 108 (*emphasis added*) with stream recovered from the anode effluent gas streams, it is positively contended that some of the unprocessed and unburned naphtha reactant being fed into the reforming unit and thereafter into the fuel cell will remain in the anode effluent gas stream and thus will be mixed at the mixing point 108 with the cooling water recirculating through the fuel cell cooling system. Accordingly, cooling fluid would includes both water and residual organic liquid naphtha as cooling liquid. That is to say, a mixture of cooling water and the unprocessed and unburned organic naphtha liquid will be circulating through the thermal exchange circuit of the fuel cell system. Therefore, those of ordinary skill, in view of Bloomfield's teachings, will envision that a mixture of liquid water and unprocessed-unburned organic liquid naphtha will be re-circulating through the cooling loop of Bloomfield's fuel cell system. Therefore, such mixture of liquid water and unprocessed-unburned organic liquid naphtha becomes the organic based liquid working fluid of the cooling fluid in the fuel cell system.

Moreover, given that the term "organic based liquid working fluid" is not defined by the claim, and the specification does not provide a standard for ascertaining the requisite degree, the examiner further contends that such cooling water mixed at the mixing point 108 with the anode effluent gas stream containing residual organic liquid naphtha (as explained by the examiner above) satisfies the claimed requirement of being the organic based liquid working fluid.

Additionally, Bloomfield clearly discloses alternate embodiments wherein the working fluid is not necessarily water (Bloomfield, COL 6, lines 10-17). In addition, the prior art further

discloses that the working fluid which is pumped around the system may be, for example, trichlorofluroethane, commonly known as Refrigerant 113, but any fluid having suitable vapor pressure and temperature characteristics may be employed (Bloomfield COL 6, lines 37-45). Thus, it is noted that the prior art has clearly envisioned and envisaged the use of an organic cooling medium in fuel cell applications regardless of whether or not the Rankine cycle loop does include the fuel cell. In that, it is further noted that a reference is good for what its teachings disclose or, at least, what the teachings, in general, of the reference would have suggested to those of ordinary skill in the art. The examiner does not understand applicants' position of arbitrarily arguing that because the Bloomfield reference teaches a separate Rankine loop, in fact, the reference is not teaching or suggesting using the chlorofluorocarbon organic cooling medium in fuel cell applications when it is remarkably outstanding that Bloomfield is addressing and solving the fuel cell heat exchanging mechanism, cycle or loop.

Therefore, one way or another and either directly or indirectly, the Bloomfield reference employs the organic cooling medium in the heat transfer cycle/loop of his fuel cell.

In response to applicant's argument that there is no suggestion to combine the references (i.e. there is no suggestion to use the turbine of Ennis et al in a rankine cycle loop that includes a fuel cell), the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this particular case, Ennis et al disclose a method and apparatus for energy fuel

conversion systems (TITLE) including fuel cells (Ennis et al: COL 4, lines 18-22/ COL 5, lines 40-45/ COL 23, lines 49-65) wherein the shaft work of the turbine can be for electrical generation only, or can also include work to operate one or more compressors or pumps (Ennis et al: COL 6, lines 4-6). Thus, Ennis et al directly teach that the shaft work of the turbine can be used to operate pumps; and therefore, this provides an efficient manner of utilizing and optimizing energy consumption in methods and apparatus of total energy fuel conversion. Accordingly, both references (i.e. Ennis et al and Bloomfield) are reasonably relevant to one another as they both address the same problem of managing efficient energy generation and consumption for energy conversions system including fuel cells.

Furthermore, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In response to applicant's argument that Keller is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Keller is found to be pertinent to the particular problem with which the applicant is concerned simply because Keller teaches the use of the claimed organic based liquid cooling fluid as a suitable refrigerant for the standard heat exchange apparatuses. Thus, one of ordinary skill in the art will find obvious to look at and use

Keller's teaching because of the functional and working similarities between the heat exchanging cooling circle of Keller which uses the specific organic based liquid cooling fluid and applicant's cooling circulation loop.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Raymond Alejandro
Examiner
Art Unit 1745

Conferees:
Pat Ryan
Steve Griffin SPE, Art Unit 1731